CLAIMS

1. An image pickup system comprising:

block extracting means for extracting a block area with a predetermined size from a signal of an image pickup device;

transforming means for transforming the signal in the block area extracted by the block extracting means into a signal in a frequency space;

noise estimating means for estimating the amount of noises of a frequency component except for a zero-order component based on the zero-order component in the signal in the frequency space transformed by the transforming means;

noise reducing means for reducing noises of the frequency component except for the zero-order component based on the amount of noises estimated by the noise estimating means; and

compressing means for compressing the zero-order component and the frequency component except for the zero-order component from which the noises are reduced.

2. An image pickup system according to Claim 1, wherein the noise estimating means comprises:

obtaining means for obtaining a temperature T of an image pickup device and a gain G of the signal;

giving means for giving standard values of the

temperature T of the image pickup device and the gain G of the signal;

coefficient calculating means for calculating coefficients A, B, and C based on three functions a(T, G), b(T, G), and c(T, G) using parameters serving as the temperature T given by the obtaining means or the giving means and the gain G given by the obtaining means or the giving means; and

noise calculating means for calculating an amount N of noises by using a value L of the zero-order component and the coefficients A, B, and C based on a functional expression [$N = AL^B + C$] or [$N = AL^2 + BL + C$].

3. An image pickup system according to Claim 1, wherein the noise estimating means comprises:

obtaining means for obtaining a temperature T of an image pickup device and a gain G of the signal;

giving means for giving standard values of the temperature T of the image pickup device and the gain G of the signal; and

look-up table means for obtaining an amount N of noises by inputting a value L of the zero-order component, the temperature T given by the obtaining means or the giving means, and the gain G given by the obtaining means or the giving means.

4. An image pickup system according to Claim 1, wherein the noise reducing means comprises:

average calculating means for calculating an average of the frequency component except for the zero-order component;

allowable range setting means for setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating means and the amount of noises estimated by the noise estimating means; and

correcting means for correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting means.

5. An image pickup system according to Claim 4, wherein the noise reducing means further comprises:

frequency separating means for separating the frequency component except for the zero-order component every predetermined frequency band; and

selecting means for selecting whether or not noises are reduced from the frequency band separated by the frequency separating means.

6. An image pickup system according to Claim 1, wherein the noise reducing means comprises:

threshold setting means for setting an amplitude value of the noise of the frequency component except for the zero-order component as a threshold value based on the amount of noises estimated by the noise estimating means; and

smoothing means for reducing an amplitude component which is below the threshold set by the threshold setting means with respect to the frequency component except for the zero-order component.

7. An image pickup system according to Claim 6, wherein the noise reducing means further comprises:

frequency separating means for separating the frequency component except for the zero-order component every predetermined frequency band; and

selecting means for selecting whether or not the noises are reduced from the frequency band separated by the frequency separating means.

8. An image pickup system according to Claim 1, wherein the block extracting means comprises chart separating means for separating a part corresponding to a gray chart from the signal obtained by picking-up an image for correction including three types or more of gray charts

with different reflectances by the image pickup device,

the transforming means transforms the part corresponding to the gray chart separated by the chart separating means into the signal in the frequency space, and

the image pickup system further comprises:

variance calculating means for calculating a variance N of the frequency component except for the zero-order component of the corresponding part of the gray chart; and

fitting means for calculating coefficients A, B, and C based on a functional formula of $N = AL^B + C$ or $N = AL^2 + BL + C$ by using a value L of the zero-order component and the variance N.

9. An image pickup system according to Claim 8, further comprising:

coefficient storing means for storing the coefficients A, B, and C calculated by the fitting means.

10. A replay system for processing a signal compressed after transformation to a signal in a frequency space, comprising:

decompressing means for decompressing the signal to the signal in the frequency space;

noise estimating means for estimating the amount of noises of a frequency component except for a zero-order

component based on the zero-order component in the signal in the frequency space decompressed by the decompressing means;

noise reducing means for reducing noises of the frequency component except for the zero-order component based on the amount of noises estimated by the noise estimating means; and

inverting transforming means for transforming the zero-order component and the frequency component except for the zero-order component from which the noises are reduced into a signal in a real space.

11. A replay system according to Claim 10, wherein the noise estimating means comprises:

obtaining means for obtaining a temperature T of an image pickup device and a gain G of the signal;

giving means for giving standard values of the temperature T of the image pickup device and the gain G of the signal;

coefficient calculating means for calculating coefficients A, B, and C based on three functions a(T, G), b(T, G), and c(T, G) using parameters serving as the temperature T given by the obtaining means or the giving means and the gain G given by the obtaining means or the giving means; and

noise calculating means for calculating an amount N of

noises by using a value L of the zero-order component and the coefficients A, B, and C based on a functional expression [$N = AL^B + C$] or [$N = AL^2 + BL + C$].

12. A replay system according to Claim 10, wherein the noise estimating means comprises:

obtaining means for obtaining a temperature T of an image pickup device and a gain G of the signal;

giving means for giving standard values of the temperature T of the image pickup device and the gain G of the signal; and

look-up table means for obtaining an amount N of noises by inputting a value L of the zero-order component, the temperature T given by the obtaining means or the giving means, and the gain G given by the obtaining means or the giving means.

13. A replay system according to Claim 10, wherein the noise reducing means comprises:

average calculating means for calculating an average of the frequency component except for the zero-order component;

allowable range setting means for setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating means and the

amount of noises estimated by the noise estimating means; and

correcting means for correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting means.

14. A replay system according to Claim 13, wherein the noise reducing means further comprises:

frequency separating means for separating the frequency component except for the zero-order component every predetermined frequency band; and

selecting means for selecting whether or not noises are reduced from the frequency band separated by the frequency separating means.

15. A replay system according to Claim 10, wherein the noise reducing means comprises:

threshold setting means for setting an amplitude value of the noise of the frequency component except for the zero-order component as a threshold value based on the amount of noises estimated by the noise estimating means; and

smoothing means for reducing an amplitude component which is below the threshold set by the threshold setting means with respect to the frequency component except for the

zero-order component.

16. A replay system according to Claim 15, wherein the noise reducing means further comprises:

frequency separating means for separating the frequency component except for the zero-order component every predetermined frequency band; and

selecting means for selecting whether or not the noises are reduced from the frequency band separated by the frequency separating means.

17. An image pickup program executed by a computer, comprising:

a block extracting step of extracting a block area with a predetermined size from a signal of an image pickup device;

a transforming step of transforming the signal in the block area extracted by the block extracting step into a signal in a frequency space;

a noise estimating step of estimating the amount of noises of a frequency component except for a zero-order component based on the zero-order component in the signal in the frequency space transformed by the transforming step;

a noise reducing step of reducing noises of the frequency component except for the zero-order component

based on the amount of noises estimated by the noise estimating step; and

a compressing step of compressing the zero-order component and the frequency component except for the zero-order component from which the noises are reduced.

18. An image pickup program according to Claim 17, wherein the noise reducing step comprises:

an average calculating step of calculating an average of the frequency component except for the zero-order component;

an allowable range setting step of setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating step and the amount of noises estimated by the noise estimating step; and

a correcting step of correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting step.

19. An image pickup program according to Claim 17, wherein the block extracting step comprises a chart separating step of separating a part corresponding to a gray chart from the signal obtained by picking-up an image for

correction including three types or more of gray charts with different reflectances by an image pickup device,

the transforming step transforms the part corresponding to the gray chart separated by the chart separating step into the signal in the frequency space, and

the image pickup program further comprises:

a variance calculating step of calculating a variance N of the frequency component except for the zero-order component of the corresponding part of the gray chart; and

a fitting step of calculating coefficients A, B, and C based on a functional formula of $N = AL^B + C$ or $N = AL^2 + BL + C$ by using a value L of the zero-order component and the variance N.

20. A replay program comprising:

a decompressing step of decompressing, into a signal in a frequency space, a signal compressed after the transformation as the signal in the frequency space;

a noise estimating step of estimating the amount of noises of the frequency component except for the zero-order component based on the zero-order component of the signal in the frequency space decompressed by the decompressing step;

a noise reducing step of reducing the noises of the frequency component except for the zero-order component based on the amount of noises estimated by the noise

estimating step; and

an inverting-transforming step of transforming the zero-order component and the frequency component except for the zero-order component from which the noises are reduced into a signal in a real space.

21. A replay program according to Claim 20, wherein the noise reducing step comprises:

an average calculating step of calculating an average of the frequency component except for the zero-order component;

an allowable range setting step of setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating step and the amount of noises estimated by the noise estimating step; and

a correcting step of correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting step.